AGENCY ~~REVIEW~~ RESPONSE DRAFT

Surface Sediment Field Sampling Plan

Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767A

~~January~~ March **23~~17~~, 2018

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CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

~~January 17~~March **23, 2018

Kenneth M. Tyrrell
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Date

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AECOM	AECOM Technical Services
ALS	ALS Environmental in Kelso, Washington
ASAOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
BL	baseline/stratified random samples
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COCs	contaminants of concern
CRD	Columbia River Datum
CSM	Conceptual Site Model
D/U Reach	the Downtown Reach and the Upriver Reach
DDx	dichlorodiphenyltrichloroethane and its derivatives
D/F	dioxins/furans
DGPS	differential global positioning system
DQOs	data quality objectives
DSL	Oregon Department of State Lands
EPA	United States Environmental Protection Agency
FC	Field Coordinator
FS	feasibility study
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
Gravity	Gravity Marine Services
ID	identification number
LWG	Lower Willamette Group
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDI	Pre-Remedial Design Investigation
PHSS	Portland Harbor Superfund Site
Pre-RD AOC Group	Pre-Remedial Design AOC Investigation Group
Pre-RD	Pre-Remedial Design
PRP	potentially responsible party
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAPP	Quality Assurance Project Plan

QC	quality control
QC	quality control
RB	rinsate blank
RI	remedial investigation
RM	river mile
ROD	Record of Decision
SG	surface sediment grabs
Site	Portland Harbor Superfund Site
SMA	sediment management area
SOP	Standard Operating Procedure
SOW	Statement of Work
SWAC	surface weighted average concentration
TB	trip blank
TestAmerica	TestAmerica Laboratories
TOC	total organic carbon
UR	D/U Reach samples

1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area (SMA) footprints, refine the Conceptual Site Model (CSM), determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) submitted a detailed Work Plan for Pre-Remedial Design Investigation and Baseline Sampling (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design Agreement and Order on Consent Investigation Group (Pre-RD AOC Group). On December 19, 2017, EPA entered into an Administrative Settlement Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The ASAOC includes a Statement of Work (SOW) and the PDI Work Plan (as an attachment to the SOW), which generally describe the agreed upon field investigation activities, data analyses, schedule, and deliverables for the PDI.

These PDI studies are a foundational step in what will be a multi-phase effort to update current conditions from the collection of data during the remedial investigation (RI)/feasibility study (FS). The RI/FS was initiated by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, fish tissue, and other media from 2001 through 2007.

This Field Sampling Plan (FSP) was prepared to support the surface sediment sampling efforts outlined in the PDI Work Plan (Geosyntec 2017) and the project Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). To the extent practicable, previously approved FSPs from the RI will be referenced.

1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown area from river mile (RM) 1.9 upstream to 11.8 and covers 2,190 acres. There are two reaches located immediately upstream of the Site. The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4. Collectively, RM 11.8 to RM 28.4 is referred to as the D/U Reach.

1.2 Project Overview

Two kinds of surface sediment data will be collected within the Site: 1) random stratified samples within a grid system (for establishing a new baseline dataset); and 2) targeted (non-random) samples located in SMA areas to support further refinement of the SMA footprints.

Additional surface sediment samples may be collected to reoccupy 2004 RI surface sediment locations. If this reoccupation of 2004 RI sampling activitiy was to occur, the same protocols would be followed outlined in this FSP and the description of the sampling activities would be developed as an addendum to this FSP and provided to EPA for consideration prior to sampling.

Surface sediment will be collected from a target depth of 0- to 30-centimeter depths, consistent with the RI (Intergral 2004). A minimum depth of 10 centimeters will be considered acceptable (especially if sampling on a sediment cap). Additionally, surface sediment samples will be collected from the D/U Reach. The D/U Reach stations will be located in sediment areas targeting fine-grained sediment and higher total organic carbon (TOC), generally similar to surface sediment within the Site; target ranges are discussed in Section 2.1.4. The sampling scheme and RAOs are also discussed in the PDI Work Plan (Geosyntec 2017).

Baseline surface sediment samples will be analyzed for the ROD contaminants of concern (COCs). Surface sediment samples from targeted (non-random) stations will be analyzed for the focused COCs, which include dichlorodiphenyltrichloroethane and its derivatives (DDx), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and dioxin/furans (D/F). All stations will be analyzed for grain size and TOC, and a portion of the fine-grained samples may be selected for Atterberg Limits geotechnical testing.

1.3 Data Quality Objectives

The stratified random surface sediment sampling effort, in conjunction with surface water and fish tissue data, will be used to update the current conditions for the full ROD suite of COCs (see ROD Table 17, relisted in Table 3 of the PDI Work Plan) and will provide a baseline for long-term monitoring and remedy effectiveness evaluations. As described in the PDI Work Plan (Geosyntec 2017), ~~T~~the SMA surface sediment sampling effort, along with baseline sampling, will help refine the CSM for the Site. Data quality objectives (DQOs) for surface sediment sampling are detailed in Table ~~2~~ 3 of the project QAPP (AECOM and Geosyntec 2018a).

2. SAMPLING DESIGN AND APPROACH

This FSP has been prepared to ensure DQOs are met. Methods for surface sediment sampling are consistent with EPA-approved sampling plans from the RI (Integral Consulting [Integral] 2002, 2004, 2006), EPA guidance on collecting sediment data (EPA 2014), and Puget Sound Estuary Program (PSEP) protocols (PSEP 1996).

For clarification, terminology used in this FSP includes:

- Surface Sediment Sample = is a grab sample targeting the upper 30 cm of the sediment bed.

- Sample Location = is the sampling point shown on maps from which a chemistry sample was collected.
- Sample Station = is the place in space where the vessel is located to collect a sample or sub-station composite sample (a, b, and c stations).
- Upriver or Upstream Area = the spatial area located immediately upstream of the Site and includes the Downtown Reach and Upriver Reach.

2.1 Surface Sediment

Two kinds of surface sediment data will be collected within the Site: stratified random samples within a grid system to establish a baseline dataset and targeted (non-random) samples located in SMA areas to support further refinement of the SMA footprints. All surface sediment sampling stations within the Site are presented in Figure 2. In addition, upriver surface sediment data will be collected to evaluate current conditions and incoming contaminant loads. All surface sediment samples will consist of a three-point composite. At each proposed station, three "grabs" will be collected within a relatively small footprint and composited into one sample for analysis.

2.1.1 Stratified Random Sampling

A total of 428 sediment samples will be collected for this DQO. The gridded random stations will be applied throughout the Site, including areas where other parties are collecting post-RI data. All surface sediment sample types, numbers, and analyses are summarized in Table 1. Section 3.2.2 of the PDI Work Plan details the rationale and statistical justification for the stratified random sampling design. In summary, the total sample count reflects the number of samples required to improve upon the level of variability in the 2004 surface weighted average concentrations (SWAC) and to enable the design to statistically detect differences ($\alpha = 0.05$) between 2004 SWACs and current SWAC estimates with an approximate 80~~%~~percent level of statistical power. The dataset will be used to establish a baseline for future long-term monitoring. All stratified random surface stations will be analyzed for the full ROD Table 17 suite of COCs, plus grain size and TOC (see Section 5 for details).

Combined with the SMA samples (see below), this sample design represents the estimated 666 surface sediment sampling stations needed to yield a statistically robust new dataset for determining SWACs at varying scales.

2.1.2 Targeted SMA Delineation

A total of 178 targeted surface sediment sample stations will be collected to support further refinement of the SMA footprints. In addition, 60 surface grab samples will be co-located with the 60 deep in-water core stations in SMA areas. A total of 238 surface sediment grab samples will be collected for targeted SMA delination. Details regarding the sediment core sampling are provided in the Subsurface Sediment Coring FSP (AECOM and Geosyntec 2018b).

The criiteria considered for the placement of SMA surface sediment samples include:

- **Pairing with Core Collection in Deep Water Areas**: collect a co-located grab sample at each of the 60 proposed sediment core locations (rationale for core locations provided in the Subsurface Sediment Coring FSP)
- **Spatial Resolution**: Place adequate number of grab samples such that a sediment sample would be present approximately every 300 feet within the SMAs
- **Reduced Uncertainty for Future Planning**: The density of SMA sampling achieves the level of precision needed to delineate SMAs within an approximate 30 percent level of uncertainty, sufficient for the needs of the Pre-RD AOC Group to support SMA delineation need during remedial design.

2.1.3 Downtown/Upriver Reaches

A total of 30 surface sediment samples will be collected from the Downtown Reach located immediately upstream of the Site, and 30 surface sediment samples will be collected from the Upriver Reach, for a total of 60 D/U Reach samples. All D/U locations will target fine-grained sediments with TOC concentrations similar to Site sediments to facilitate matching the D/U sediments with the Site sediments.~~All D/U locations will target fine-grained sediments with total organic carbon in an attempt to match TOC and fine-grained sediments within the Site sediments.~~

~~Proposed locations are presented in Figure 4.~~ A review of previous sediment studies' available grain size data and bathymetry data was conducted to select initial target areas in the D/U Reach (RI/FS database; GSI Water Solutions, Inc. [GSI] and Hart Crowser 2010; GSI 2014; Kleinfelder 2015; Hart Crowser 2002). Samples were randomly placed in areas with more than 35~~50~~ ~~%~~ percent fines (sum of clay and silt fractions, defined as material passing through a #200 sieve for American Society for Testing and Materials [ASTM] grain size). The random placement process is comparable to the stratified random sampling design used within the Site as both used the same industry standard geospatial randomization algorithm for spatial coverage in GIS. However, where the stratified random samples within the Site were placed using a weighted grid (smaller cells near the banks, wider in the navigation channel), no grid was used for the D/U Reach samples as these are being randomized across areas with more than 35 percent fines. The randomization of each sampling location within a grid cell is comparable to the randomization of a sample location within the targeted area of more than 35 percent fines. Figure 3 presents the available percent fines data in the D/U Reach, and Figure 4 presents randomly placed proposed locations based on the initial desktop study. However, the actual collection locations will be selected based on confirmation of sufficient fine-grained sediment and TOC presence (see below).

2.1.4 Pre-Screening D/U Sediments for Grain Size and TOC

It is critical that D/U Reach samples have grain size and TOC fractions similar to Site conditions, so they can be representative comparisons to the Site. In addition, cleanup levels for organic sediment COCs in the ROD are dry weight based values (i.e., not normalized for organic carbon content); therefore, TOC is required to be within the range of Site conditions for concentrations of organic chemicals in D/U sediments to be evaluated within the context of cleanup levels for the Site. For reference, ~~T~~the average ~~and median~~ site-wide TOC is 1.8 percent (median of 1.7 percent) with a distribution range of 0.04 to 27 percent. The mean grain size distribution of site surface sediments is classified as a sandy silt. The average upriver TOC concentration is 1.1 percent with a range of 0.033 to 13 percent depending on the river reach. The TOC distribution in the Downtown Reach appears to be different from the upper reaches, especially from RM 22.7 to RM 28.4 where the sediment facies may be different. The historical data ~~do not always~~generally show ~~high~~good correlation between percent fines and TOC (r^2 = 0.90), however neither percent fines alone or TOC alone are always well correlated with concentrations of organics. Based on an evaluation of paired upstream data, the correlation between percent fines and concentrations of total PCBs is low (r^2 = 0.18), however the correlation between TOC and concentrations of total PCBs in sediment is signficant (r^2 =0.42). ~~;~~ ~~t~~Therefore, consideration of both parameters is required to ensure that the D/U Reach samples are appropriate for comparison to within Site data. ~~screening visually only for grain size will not be adequate to determine if TOC fractions are appropriate. Both parameters will be evaluated.~~

The process for determining D/U Reach sample locations based on grain size and TOC considerations is provided in Figure 5, and described below. In brief, the following steps will be performed:

1) Visual reconnaissance to map areas of fine grain sediments (>35 percent fines)~~.~~
2) Placement of randomized sample locations within mapped areas of >35 percent fines.
3) Collection of surface sediment samples for full volume of sediment needed for analyses~~)~~.
4) Expedited analysis of TOC and grain size
~~1)~~5) Decision criteria (target range) applied to each sample location, then either resample or analyze for full suite testing

As shown in Figure 5, geotechnical analyses may be performed based on grain size results~~;~~, however, these do not impact the decision criteria. This process has been designed to result in a total of 60 D/U Reach surface sediment samples as presented in the PDI Work Plan with the highest likelihood of TOC and grain size that are appropriate for comparision to Site data. Each step is described in detail below.

Visual Reconnaissance. A field reconnaissance survey will be conducted prior to sampling to confirm a target area containing fine sediments. First, the sediment bottom will be probed using a steel-tipped rod to confirm the presence of fine-grained sediments in expected areas based on the desktop review of available grain size data. Best professional judgement can easily distinguish

between predominantly coarse-grained material (sand and gravel) versus predominantly fine-grained material (silt and clay, and up to some sand). Second, an aliquot of mud will be collected (using the hydraulic power grab) and the sediment grain size fractions will be visually classified according to ASTM visual-manual soil classification methods for particle size (e.g., cobbles, rocks, silt, sand). The field staff will refer to the ASTM Unified Soil Classification System Log Key 2 (Appendix A-1). Visual inspections will include recording of the presence/absence of organic matter, organic silt, leaf litter, roots, rootlets, and other organic matter that may indicate the presence of TOC.

Mapping of Grain Size and Placement of Sample Locations: ~~Third,~~ ~~a~~Areas containing an estimated > 35 percent fines and presence of organic matter based on the visual reconnisance will be mapped in GIS. ~~and sampled.~~ ~~The~~ There are 60 proposed locations shown in Figure 4; if any of the currently proposed locations fall outside of the areas of >35 percent fines determined by the visual reconnisance, these locations will be re-located randomly within the areas of target percent fines.

Sample Collection.: Following the mapping of grain size and re-randomization of sample~~s~~ locations, it is anticipated that surface sediment sampling within the Site will still be on-going. At this point, the sampling vessel will return to the D/U Reach and all 60 D/U Reach sample lcoations will be sampled. Surface sediment samples will be collected, processed, and packaged (as described below) from all 60 D/U Reach sample locations.

Expedited TOC and Grain Size Analysis. The ~~F~~full sets of samples and jars collected will be submitted to the designated analytical lab. All analyses will be held, pending the result of a quick turnaround analysis of TOC by EPA Method 9060 and grain size by ASTM D7928 / D6913. Grain size analysis will include both the coarse- and fine fraction estimation of the sample (sieves and hydrometer), including determination of silts and clays.

- The target range for TOC is between 1 and 2.5 %
  - Analysis of available upstream data shows this range of TOC correlates with fines ≥ 35 % and is consistent with the Site distribution of TOC (average of 1.8 %)
  - No samples will be analyzed with TOC < 0.5 %
- The target criteria for grain size is > 35 % fines with some clay present. No samples will be analyzed if < 35 % fines

Review of Decision Criteria - Analysis of ROD Table 17 COCs or Resample. Following expedited analysis of TOC and grain size, all samples meeting the criteria described above will be analyzed for the complete list of ROD Table 17 sediment COCs. Samples that do not meet the criteria for either TOC or grain size, will be relocated. To relocate samples, the results of expedited TOC and grain size will be mapped in GIS and areas that meet both target criteria will be identified. Sample locations requiring relocation will be randomly placed in the newly mapped areas, using the same industry standard randomization algorthym in GIS used previously (See Section 2.1.3), and sampled.

In the event that data indicate areas with target ranges of TOC and grain size in the D/U Reach are spaitially limited, then multiple samples may be grouped in smaller areas and analysis of samples outside of the target range for TOC will be considered. However, no samples below the minimum requirements for TOC (0.5 percent) and grain size (< 35 percent) will be analyzed.

~~The target range for TOC follows:~~

- ~~No sample will be collected/analyzed < 0.5% TOC.~~
- ~~Target range for TOC is +/- 0.7% around the site-wide mean of 1.8% (between 1% and 2.35%) based on the distribution of site data. Analysis of available upstream data shows this range of TOC correlates well with fines >35% and is consistent with the Site distribution of TOC (average of 1.8%). If there is difficulty in obtaining sufficient samples using this target range, samples with TOC outside of the range will be considered, but no samples will be analyzed with TOC < 0.5%.~~
- ~~If TOC is > 8%, then site conditions will be evaluated before accepting the sample.~~

~~The target range for grain size fractions follows:~~

- ~~No sample will be collected/analyzed < 35% fines.~~
- ~~Some clay is present.~~
- ~~The nature of the silt and clay fractions is evaluated, with a target of organic silt and non-mineral clay fractions; this may require additional analysis.~~

~~**Additional Data Evaluation and Analysis.**~~ Once laboratory TOC and grain ~~-~~size fractions are confirmed to be within the targeted range, a subset of up to 10 samples with > 50 percent fines will be analyzed for Atterberg Limits testing to further classify fine-grained sediments. Methods for Atterberg Limits are noted in FSP Table 7 and in the project QAPP (AECOM and Geosyntec, 2018a). ~~Spatial patterns and correlations among results will be evaluated. After this evaluation, remaining samples deemed to be appropriately representative of site conditions will be analyzed for the full suite of ROD Table 17 COCs. In the event that a sample(s) is not within the acceptable range (both components are important), these sample location(s) will not be analyzed without further discussion with the Pre-RD AOC Group and EPA. A sample may be analyzed if it is above the minimum TOC requirement, or below the maximum, or an alternate station may be selected in the field and resampled.~~

2.2 Sample Identification

2.2.1 Sample Types, Locations, Depths

Consistent with the previous RI/FS protocol, surface sediment samples will be collected from 0 to 30 centimeters. Proposed surface sediment sample stations within the Site are provided in Figure 2 and in the D/U Reach in Figure 4. Sample location coordinates and sample identification numbers (IDs) are provided in Table 2. All surface grab samples will be collected

as three-point composites with a hydraulic power grab sampler (see Section 4.3 below for more details).

Additionally, two alternative stations for the stratified random samples are provided in Figure ~~5~~ 6 and Figure ~~6~~7. Stations were re-randomized within each grid, using the same approach as the parent sample (see Section 4.4 below for more details on the rationale for selection of the two alternative stations).

2.2.2 -Sample Nomenclature

Sample nomenclaure will be developed in a manner similar to the RI Round 1 FSP (Integral 2002, Section 4.2). In brief, all samples will have a unique identifying sample ID that includes the following:

- Project phase (PDI).
- Sample matrix (SG [sediment grab]).
- Sample Area (B for baseline/stratified random samples and D/U Reach). All baseline sample stations will be numbered B001 through B428 and D/U Reach stations will be numbered B429 through B489 (N=60). All SMA or in-water core location stations will be numbered sequentially S001 through ~~S168~~ S238 (N=178 targeted SMA grab samples, N=60 in-water SMA core location samples). All surface sediment sample locations are numbered sequentially from downstream to upstream.
- Unique, sequential station number (001 to ### per sample area).
- Sampling round (BL1 [baseline monitoring round 1]).

For example, a surface grab sample from the 428th stratified random sampling location would have the sample ID PDI-SG-B428-BL1. See Section 4.2.1 of the QAPP for nomenclature associated with field duplicates and other quality assurance (QA)/quality control (QC) samples. Additional data fields that describe each unique sample features, location, composite type will be recorded in the field forms and will be included in the project database, as described in the project Data Quality Management Plan (DQMP).

2.3 Sampling Schedule

The overall project schedule is outlined in the PDI Work Plan (Geosyntec 2017). Surface sediment grab sampling is targeted for First Quarter of 2018. EPA will be notified 1 to 2 weeks prior to sampling. Surface sediment sampling is expected to last 2 months using two sampling vessels. About 1 month into the program, progress will be assessed and, if it appears that the sampling effort is behind schedule, a third boat and crew will be mobilized to complete the sampling in the targeted 2-month period.

3. PROJECT ORGANIZATION/FIELD TEAM

3.1 Team Organization and Responsibilities

Team organization is detailed in the PDI Work Plan and in Section 2 of the QAPP (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. The PDI Project Coordinator, Mr. Ken Tyrrell, and PDI Project Manager, Dr. Jennifer Pretare, PhD (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables. Ms. Anne Fitzpatrick (Geosyntec) is the project's senior technical lead for this task. Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be generally responsible for general field QA/QC oversight. The project chemists, Ms. Julia Klens-Caprio (Geosyntec), Ms. Amy Dahl (AECOM), and Ms. Karen Mixon (AECOM), will be responsible for coordination with labs regarding sample volumes, logistics, schedule, detection limits and matrix interferences, and ensuring overall data quality.

Gravity Marine (Gravity), of Fall City, Washington, will perform vessel support, with Shawn Hinz acting as a point of contact. Analytical laboratories include ALS Environmental (ALS) in Kelso, Washington, and TestAmerica Laboratories (TestAmerica) in Fife, Washington, Sacramento, California, and Knoxville, Tennessee.

3.2 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). In brief, the Field Coordinators, Ms. Nicky Moody (AECOM) and Mr. Keith Kroeger (Geosyntec), will be the points of contact for field staff during the implementation of this FSP. Anne Fitzpatrick (Geosyntec) will be the senior technical lead for this task. Deviations from this FSP or the project-specific QAPP will be reported to Dr. Pretare, the PDI Project Manager, for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

3.3 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 to 2 weeks prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

Split samples for chemical analyses can be provided to EPA upon its request. EPA's Project Manager should contact the PDI Project Coordinator to coordinate this activity and determine appropriate logistics. If EPA elects to collect split samples, collection at stations where blind

field duplicates are taken is recommended so that EPA's comparison samples can be evaluated relative to the field and analytical variability measured by the project team.

4. SAMPLE COLLECTION PROCEDURES

The following sections describe the procedures and methods that will be used during surface sediment sampling, including sampling procedures; recordkeeping; sample handling, storage and shipping; and field quality control procedures. All field sampling activies will follow procedures outlined in the project Health and Safety Plan (AECOM and Geosyntec ~~2018b~~2018c).

4.1 Sampling Vessels and Equipment

Gravity will perform the surface sediment sampling activities. Gravity will utilize two sampling vessels, RV *Cayuse* and RV *Tieton*, equipped with hydraulic power grab samplers to complete the work. Both vessels have a virtual anchoring system that incorporates an autopilot and two small motors to keep the vessel on station without needing to set fixed anchors. The RV *Cayuse* is a 26-foot research vessel with landing craft design, crew cabin, and forward working area. The vessel has an A-frame with a custom research winch and dynamic positioning system. The RV *Tieton* is a 34-foot research vessel with landing craft design and crew cabin, pilot house, and forward working area. The vessel has an A-frame with custom research winch and dynamic positioning system. Supplemental vessels are available if additional or backup support for in-water sampling is needed. All vessels will be mobilized from Swan Island Launch.

Equipment and supplies will include all equipment for positioning, sampling, processing, recording, and shipping samples. Sample containers and preservatives, as well as coolers and packing material, will be supplied by the analytical laboratory. An equipment checklist is provided in Appendix A-~~1~~2.

4.2 Station Positioning and Vertical Control

Station positioning and vertical control will be performed as ~~outlined in detail~~detailed in the attached SOP (Appendix B-1). ~~RI Round 1 FSP (Integral 2002).~~ A differential global positioning system (DGPS) unit will be used to confirm the horizontal sampling locations to an accuracy of 1 to 2 meters. The DGPS accuracy will be confirmed each morning and evening to a known land-based survey point. Confirmed station locations will be recorded to the nearest whole foot in North American Datum 1983 (NAD83) Oregon State Plane North datum.

Vertical control will be established using an on-board fathometer or lead line to measure depth to mudline at sampling locations. The fathometer accuracy will be checked regularly by Gravity and calibrated when necessary following ASTM D6318 Standard Practice for Calibrating a Fathometer Using a Bar Check Method or other similar practice. Water depths will be converted to elevations in feet North American Vertical Datum of 1988 (NAVD88) based on the river stage

at the time of sampling as recorded at the Morrison Street Bridge located at RM 12.7. Water levels will be recorded to the nearest one tenth of a foot in the datum specified in the DQMP (AECOM and Geosyntec 2018c2018d). Further details are provided in Section 5.2 of Integral (2002).

4.3 Sample Collection and Processing

In general, sample collection will be performed as described in the RI Round 1 FSP (Integral 2002), RI Round 2 FSP for Sediment Sampling and Benthic Toxicity Testing (Integral 2004), and the RI Round 3 FSP for Upstream and Downstream Sediment Sampling (Integral 2006) with modifications described herein.

Key changes from the RI Round 1 FSP include the following:

- Samples will be collected as three-point composite samples.
- Sediment will be collected from 0 to 30 centimeters (consistent with the Round 2 and Round 3 FSPs).
- Samples will be processed on the sampling vessel. Samples will be transported in coolers on ice to the field lab for sample packaging and shipment. The AECOM Sample Processing Facility at 1116 SE Caruthers Street, Portland, Oregon, is approximately 20 blocks from the Site and will be used as a base for staging work, core sample processing, sample storage, sample packaging and shipping, daily field team meetings, gear storage, decontamination, and other field support needs.
- The hydraulic power grab was designed and manufactured by Gravity Marine. The hydralic power grab is 26 inches long, by 16 inches wide with a 14 inch grab depth. The approximate sampling volume is 0.3 cubic meters.

Section 5.6.1 of Integral (2002) provides additional details on sampling and record keeping. Standard Operating Procedures (SOPs) from the RI will be followed. The Surface Sediment Sampling SOPs isare from Appendix F of the LWG FSP for RI Round 2 (Integral 2004) and are , is provided in Appendix B-12, and consistent with Appendix D of the LWG FSP for RI Round 3 (Integral 2006), which was previously approved by EPA. These SOPs include lists of needed supplies and equipment, and SOPs for equipment decontamination, sediment sample collection, and sediment sample processing procedures. ,—Procedures regarding the chain-of-custody, packaging, and shipping samples are presented in Section 4.3 of the project QAPP (AECOM and Geosyntec 2018a), and are consistent with those in the Surface Sediment Sampling SOP (Integral 2004). The SOPs will be available in hard copy and on the project SharePoint site for easy access by the field crews.

The hydraulic power grab samplers (similar to a van Veen grab sampler but with power-assist) will target collection of sediment from the upper 0 to 30 centimeters of sediment at three sampling points at each sample location (without adjusting vessel position); the three grab

samples will be composited into a single sample for analysis. The three-point composite sample will be collected within a relatively small footprint around the sampling vessel (i.e., less than 25 feet). For example, grab #1 will be deployed, accepted, and processed on the deck of the vessel. The sampling vessel~~'s overhead winch may pivot~~will then shift approximately 5 to 10 feet from the original sample location either using the vessels engines or by pulling in 5 feet on one anchor while releasing 5 feet on the other anchor.~~, and t~~This~~e~~ process will be repeated until there is an equal volume of sediment from the three grabs. Approximately 20 ounces (oz) (equal volume) of sediment will be collected from each of the three surface grabs. The sediment will be sampled~~r~~ using a stainless-steel spoon, then placed in a 20-oz jar or similar container, scoop or device (to estimate the equal volume), then transferred to a stainless-steel bowl for compositing. The spoon and container will be rinsed free of solids between subsample composite stations, but not decontaminated. Decontamination of the power grab and field equipment will take place between sample stations (as detailed in Section 4.7~~ of this FSP~~).

In general, the volume of sediment from the three-point surface grabs will be homogenized until uniform in color and texture. Color and texture will be described ~~,~~ ~~as described in more detail in~~following the ASTM visual-soil classification method (Appendix A-1~~2~~), ~~Section 5.6 of RI Round 1 FSP (Integral 2002), Section 4.6 of RI Round 2 FSP (Integral 2004), and Section 5.6 of RI Round 3 FSP (Integral 2006)~~. Sediments will be collected from the hydraulic power grab using a stainless-steel spoon, avoiding sediments in contact with the sides of the power grab. Large organisms and pieces of debris will be removed and noted in the sample log sheet (Appendix A-3). Acceptance criteria include the following (PSEP 1996; Integral 2004):

1. No or minimal excess water leaking from the jaws of the sampler.
2. No excessive turbidity in the overlaying water of the sampler.
3. Sampler did not over-penetrate.
4. Sediment surface appears to be intact with minimal disturbance.
5. Program-specific penetration (target 30 centimeters) has been achieved (minimum of 20 centimeter).

After sample acceptance, the sediment will be placed in a large, stainless-steel bowl for homogenization. Once the volume of sediment from each grab has been homogenized to a uniform consistency and color, composited sediments will be visually described following ~~American Society for Testing and Materials (USCS~~ ASTM~~)~~ visual-soil classification procedure in the field log book (Appendix A-1). Sediments will be placed in the appropriate laboratory-provided sampling containers and stored in a cooler at 4 degrees Celsius (°C) until transport to the laboratory.

4.4 Contingency Plan for Field Condition Impediments to Collecting Samples

During the sediment grab sampling efforts, the field crew may encounter field conditions that preclude collection of grab samples at the planned stations (e.g., limited access, poor recovery, safety concerns, debris/rock/bedrock causing refusal). A total of three attempts will be made to relocate the sample to an area within a 25-foot radius of the planned station.[1] If an acceptable sample cannot be obtained within 25 feet, sample collection from within a 25-foot to 50-foot radius will be attempted.

For stratified random sample locations, if a sediment grab sample cannot be collected from within 50 feet of the target location due to inaccessibility or three failed grab attempts, the re-randomized Alternate Location 1 (Figure 65) ~~may~~ will be attempted ~~in coordination with the PDI Project Coordinator and EPA~~. If the Alternate Location 1 is inaccessible or three failed grab attempts occur, the re-randomized Alternate Location 2 (Figure 76) ~~may~~ will be attempted ~~in coordination with the PDI Project Coordinator and EPA~~. The field staff will notify the PDI Project Manager as soon as it is determined that a primary location and both alternatives cannot be sampled due to inaccessibility, and the EPA will be notified immediately by the PDI Project Coordinator. If three attempts at Alternative 2 locations fail to produce acceptable grab samples, then the three best sample attempts at this location will be retained for sample processing. The sampling depth will be recorded in the field notebooks. Sample location coordinates for Alternate 1 and Alternate 2 are provided in Tables 3 and 4, respectively. Alternate sampling locations were re-randomized using a GIS randomization program to maintain the geostatistical methods used during development of the PDI Work Plan (Geosyntec 2017). The rationale for moving to Alternate Location 1 or, if needed, Alternate Location 2, will be documented in the field log.

For SMA target locations, the radius protocol described above will be used. The re-randomization geostatistical methods are not necessary as a contingency plan for the SMA locations as these locations were not randomly generated. ~~The re-randomization geostatistical methods are not necessary for the SMA locations as a means to address as a contingency plan.~~ In the event that field conditions preclude the field crews from collecting proposed target samples within SMAs, attempts from within a 25-foot to 50-foot radius will be continued until an acceptable grab is obtained.

4.5 Sample Handling and Transport

Chain-of-custody procedures will be followed as detailed in Section 4.3 of the project QAPP (AECOM and Geosyntec 2018a). These methods are consistent with the ~~in the~~ RI Round 1 FSP

[1]Distances proposed in this FSP were based on previous sediment project experience in EPA Region 10.

(Integral 2002) and similarly described in the RI Round 2 FSP and RI Round 3 FSP (Integral 2004 and 2006). Samples will be stored on ice at a temperature of 0 to ~~less than 4~~6°C in a field cooler and shipped to appropriate laboratories (See Section 4.3.4 Sample Packing and Shipping in project QAPP). ~~as detailed in the RI Round 1 FSP (Integral 2002) and similarly described in the RI Round 2 FSP and RI Round 3 FSP (Integral 2004 and 2006). Sections 4.8.1 and 4.8.2 of the RI Round 2 FSP, along with the SOPs in Appendix E of the RI FSP for Round 2 (Integral 2004) and Appendix D of the RI FSP for Round 3 (Integral 2006), provide additional details on custody, storage, and shipping details, respectively. Additional details are provided in Section 4.3 of the QAPP (AECOM and Geosyntec 2018a).~~

4.6 Field Logbook and Forms

All field activities will be recorded in a field logbook as outlined in Section 4.10.1 in the project QAPP (AECOM & Geosyntec, 2018d), consistent with ~~detail~~ Section 5.3 of the RI Round 1 FSP (Integral 2002). Field forms (Appendix A-3 of this FSP) will be completed as outlined in the project QAPP (AECOM & Geosyntec, 2018d), consistent with ~~detail in~~ the RI Round 1 FSP (Integral 2002).

4.7 Decontamination Procedures

Equipment decontamination procedures will be performed as outlined in ~~detail in the Round 1 FSP (Integral 2002) and provided in~~ the RI Round 2 FSP Appendix F Sediment Sampling SOP (Integral 2004) provided in this FSP as Appendix B-2~~1~~. This SOP is consistent with the RI Round 3 FSP Appendix D Sediment Sampling SOP (Integral 2006). Decontamination of field sampling equipment will occur between stations. For the 3~~thtee~~-point composite sub-stations from which a composite sample will be generated, the grab sampler will be rinsed/sprayed with river water until all solid material is removed. Stainless steel sampling spoons will be rinsed with river water to remove residual solids between sub-stations and re-used among sub-sampling composite stations. Re-usable sampling equipment will be decontaminated between stations.~~New sampling spoons will be used per sub-station.~~ In summary, the decontamination steps will include an initial rinse with vessel river water to dislodge particles, a scrub with brush and Alconox™ or other phosphate-free detergent, and then a rinse with deionized water. Additional rinses with nitric acid or methanol are not anticipated but may be considered based on sample conditions (e.g., excessive oily/tar residue). ~~Rinses using nitric acid or methanol will be handled and disposed of according to RI Round 2 FSP Appendix F SOP.~~ Sampling spoons and bowls will be covered with aluminum foil until use (dull side down).

4.8 Investigation-Derived Waste Disposal

Investigation-derived waste (IDW) disposal will occur as described in ~~the RI Round 1 FSP (Integral 2002, see Section 5.7) and~~ the Management of IDW SOP (Appendix B-2~~3~~). In general, any excess water or sediment remaining after processing will be returned to the vicinity of the collection site. Any water or sediment spilled on the deck of the sampling vessel will be washed

into the surface waters at the collection site before proceeding to the next station. Phosphate-free detergent-bearing liquid wastes from decontamination of the sampling equipment will be washed overboard or disposed into the sanitary sewer system.

Tyvek, gloves, paper towels, plastic sheeting, and other waste material generated during sampling will be placed in heavyweight garbage bags or other appropriate containers and placed in normal refuse containers for disposal at a solid waste landfill.

4.9 Field Quality Control

All QA/QC procedures are detailed in the QAPP (AECOM and Geosyntec 2018a). Requirements for QA/QC samples are provided in Table 5, and a summary of all field QA/QC sample numbers is provided in Table 6. In brief, homogenized blind field duplicates will be collected from the same composited bowl of homogenized sample on 5 percent of the samples to assess variability within samples. Other field QC samples, such as trip blanks, temperature blanks, and rinsate blanks, will be collected per sampling vessel (as needed) as outlined in Section 4.6.1 of the QAPP.

5. LABORATORY ANALYSIS

With the large numbers of samples and multiple analytes, it is best to separate the sample analyses among laboratories that specialize in certain analytical methods and have the capacity to complete the work on schedule. As such, the Pre-RD AOC Group has selected the following laboratories to perform the physical and chemical analyses:

- ALS in Kelso, Washington, will analyze for chlorinated pesticides, PAHs, bis-(2-ethylhexyl) phthalate, tributyltin, and total solids.
- TestAmerica in:
    - Fife, Washington, will analyze for total petroleum hydrocarbons diesel range, metals, TOC, grain size, and total solids.
    - Sacramento, California, will analyze for dioxins/furans.
    - Knoxville, Tennessee, will analyze for PCB congeners.

The analytes and analytical methods are provided in Table 7 for each sample type. Additional details on the analytical methods, QA/QC requirements and procedures, and laboratory-specific QA/QC requirements are detailed in Sections 4.5 and 4.6 of the QAPP (AECOM and Geosyntec 2018a). All samples will be placed in laboratory-supplied sample containers and preserved according to analytical protocols. Sample containers, preservation requirements, holding times, and sample sizes are provided for all analyses in Table 8.

6. DATA MANAGEMENT AND REPORTING

6.1 Field Data Management

The procedures and activities outlined in this FSP are designed to ensure DQOs outlined in the PDI Work Plan are met. Specifically, and as detailed in Sections 4.2, 4.3, 4.6, and 4.10 in the QAPP (AECOM and Geosyntec 2018a), the following data management procedures will be performed in the field:

- All samples will be given a unique identifier (Section 2.2 of this FSP).
- All samples will be collected and transported under chain-of-custody control (Section 4.5 of this FSP).
- Field logbooks and data sheets will be maintained (Section 4.6 of this FSP).
- Field QA/QC samples will be collected according to the QAPP (Section 4.9 of this FSP).

6.2 Post-Analysis Data Management and Reporting

Analytical laboratories will be required to adhere to all QA/QC procedures outlined in the QAPP. Laboratories will provide all data for field investigations in electronic format and QA/QC reports, including a narrative of the standard QA/QC protocols. Data validation and data management will be performed according to the QAPP and DQMP (AECOM and Geosyntec 2018d). Following data validation, all data, supplementary information, and validator qualifiers will be compiled into an SQL Server database for the project. Data summary files will be provided to EPA as they become available after data validation and database management.

Results from the implementation of this FSP will be used to support the data use objectives described in Section 1.3 of the PDI Work Plan (Geosyntec 2017: Table 5). Data summaries and evaluations will be included in the PDI Evaluation Report.

7. REFERENCES

AECOM (AECOM Technical Services) and Geosyntec (Geosyntec Consultants, Inc.). 2018a. Draft Quality Assurance Project Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. ~~January~~March.

AECOM and Geosyntec. 2018b. Subsurface Sediment Coring Field Sampling Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site, Portland Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10, Seattle, WA. March.

AECOM and Geosyntec. ~~2018b~~2018c. Health and Safety Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. ~~January~~13 March.

AECOM and Geosyntec. ~~2018c~~2018d. Data Quality Management Plan Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling. Portland Harbor Superfund Site. ~~January~~ 22 February.

American Society of Testing and Materials (ASTM). ASTM D-2488-93. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). pg. 225-235.

ASTM D6318-03. 2014. Standard Practice for Calibrating a Fathometer Using a Bar Check Method, ASTM International, West Conshohocken, PA, 2014

EPA (United States Environmental Protection Agency). 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Third Edition, Update V.

EPA. 2016a. Portland Harbor RI/FS, Final Remedial Investigation Report, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 8 February.

EPA. 2016b. Portland Harbor RI/FS, Final Feasibility Study, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. June.

EPA. 2017a. Record of Decision Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. January.

EPA. 2017b. ASAOC between US EPA and the Pre-RD AOC Group for Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland Oregon. United States Environmental Protection Agency Region 10, Seattle, Washington. 18 December.

Geosyntec (Geosyntec Consultants, Inc.). 2017. Final Work Plan, Portland Harbor Pre-Remedial Design Investigation Studies, Portland Harbor Superfund Site, Portland, Oregon. Prepared for the Pre-RD AOC Group for submittal to EPA Region 10. Attachment to the Statement of Work. 19 December.

GSI Water Solutions, Inc. (GSI), and Hart Crowser, Inc. 2010. Field and Data Report, Downtown Portland Sediment Characterization Phase II, Willamette River, Portland, Oregon. Prepared for Oregon Department of Environmental Quality. June.

GSI. 2014. Supplemental Remedial Investigation/Feasibility Study Field Sampling and Data Report, River Mile 11 East, Portland, Oregon. Prepared for RM11E Group. July.

Hart Crowser. 2002. Volume I Lower Willamette River Reference Area Study. Prepared for the U.S. Army Corps of Engineers. 9 April.

Integral (Integral Consulting). 2002. Round 1 Field Sampling Plan. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 14 June.

Integral. 2004. Round 2 Round 2 Field Sampling Plan - Sediment Sampling and Benthic Toxicity Testing Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. ~~22 March~~21 June.

Integral. 2006. Preliminary Upstream & Downstream Sediment Data Evaluation and Round 3A Field Sampling Plan for Upstream & Downstream Sediment Sampling. Prepared for the Lower Willamette Group (LWG) for submittal and approval by EPA Region 10. 13 October.

Kleinfelder. 2015. Sediment Sampling Data Report, Portland Harbor, Portland, Oregon. Prepared for de maximis Inc. 1 June.

PSEP (Puget Sound Estuary Program). 1996. Puget Sound Estuary Program: Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound. Final Report. TC-3991-04. Prepared for U.S. Environmental Protection Agency, Region 10 and Puget Sound Estuary Program, Seattle, Washington. Tetra Tech and HRA, Inc., Bellevue, Washington.

TABLES

FIGURES

APPENDIX A - Sediment Logging Keys, Equipment Checklist, and Field Forms

APPENDIX B – Standard Operating Procedures

B-1. Horizontal and Vertical Station Control

B-2. Surface Sediment Sampling (Integral 2004) ~~SOP~~

B-3. Management of IDW ~~SOP~~

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